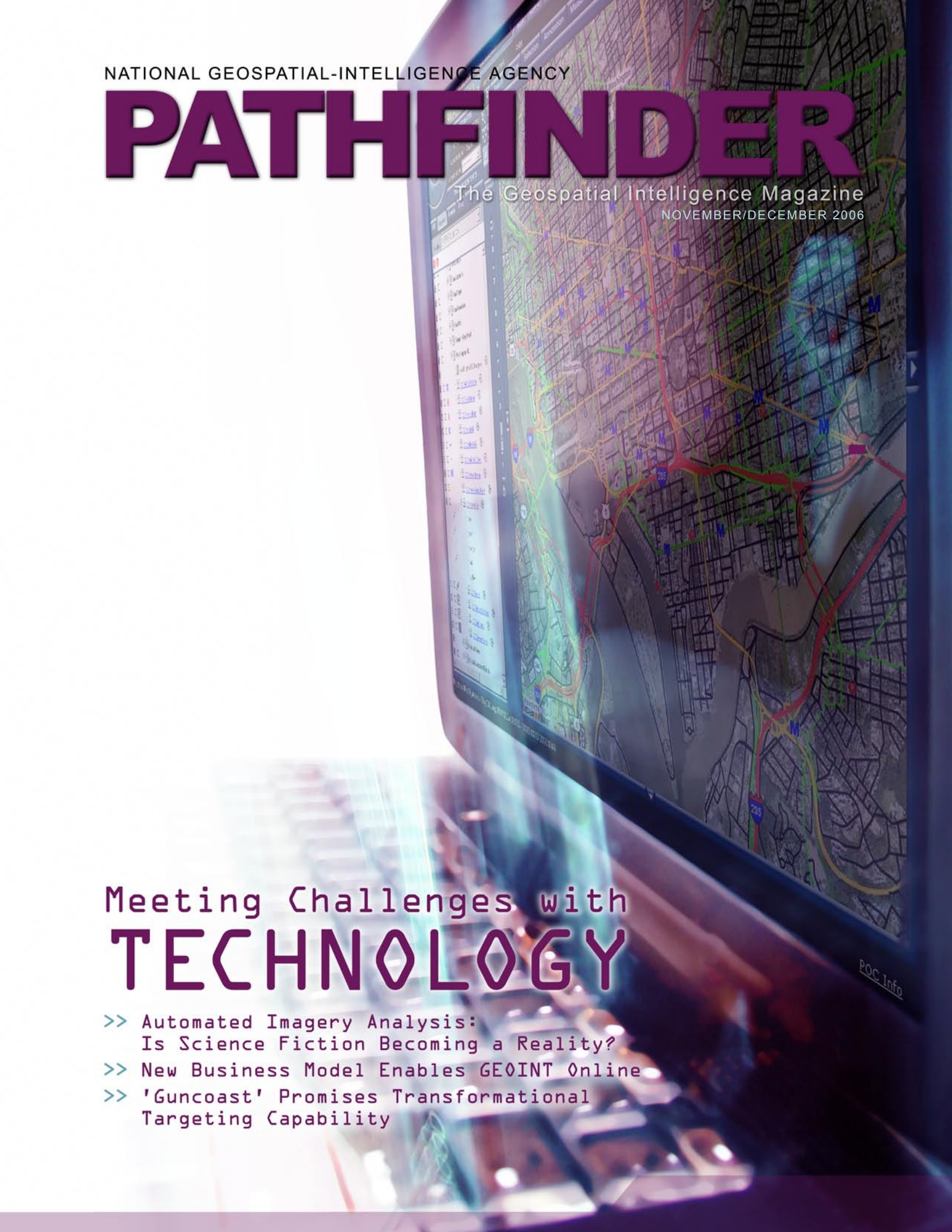
NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

PATHFINDER

The Geospatial Intelligence Magazine

NOVEMBER/DECEMBER 2006



Meeting Challenges with TECHNOLOGY

>> Automated Imagery Analysis: Is Science Fiction Becoming a Reality?

>> New Business Model Enables GEOINT Online

>> 'Guncoast' Promises Transformational Targeting Capability

Contents

PATHFINDER
November/December 2006
Vol. 4, No. 6

ON THE COVER

The increased availability of information over the Internet has expanded humankind's knowledge base, while also aiding our adversaries. Through many initiatives, NGA is striving to meet the challenge of showing the way in constantly changing scenarios. ©2006 Getty Images.

GETTING PUBLISHED

All members of the geospatial intelligence community are welcome to submit articles of community-wide interest. Articles are edited for style, content and length. The copy deadline is the last Friday of the third month before publication. For details on submitting articles, send an e-mail to pathfinder@nga.mil.

Published by the National Geospatial-Intelligence Agency
Director—Vice Adm. Robert B. Murrett
Office of Corporate Relations,
Director—Paul Weise
Deputy Director—Art Haubold
Visual Communications Division,
Chief—Richard Hardwick
Designer—Laura Garber
Strategic Communications Branch,
Chief—Louis Brune
Editor—Paul Hurlburt
Managing Editor—Jennifer Harris
Correspondence should be addressed to:
Pathfinder, National Geospatial-Intelligence Agency
Office of Corporate Relations
Strategic Communications Branch
(OCRNS)
4600 Sangamore Road, Mail Stop D-54
Bethesda, MD 20816-5003
Telephone: (301) 227-7388,
DSN 287-7388, or
In St. Louis: (314) 263-4142,
DSN 693-4142.
E-mail: pathfinder@nga.mil

About the Authors

Thomas Schellingerhout manages the Master of Science of Strategic Intelligence program in St. Louis. A retired Army colonel, he works for Northrop Grumman as an education plans and programs specialist in the Career Development Department of the James R. Clapper Jr. School of Leadership and Professional Development.

Susan Meisner is a Public Affairs Staff Officer in the Office of Corporate Relations.

Dr. Keith Littlefield is NGA's Director of InnoVision. He was the first director of the Joint Mangement Office established by the Director of Central Intelligence in 2002 to formulate and execute an end-to-end Future Imagery Architecture closure plan.

Joanna Davis is a contract technical writer supporting the InnoVision Directorate communications team. She began her NGA support after serving as a communications specialist at the Defense Intelligence Agency.

Jennifer Lafley is the InnoVision Directorate Communications Team Lead. She was Media Chief for the Military District of Washington before returning to NGA, where she worked previously in public affairs.

Gary W. Fuller is an Executive Adviser with Booz Allen Hamilton supporting the Geospatial Intelligence Enterprise Integration Team. He has supported the Intelligence Community for 35 years as a government employee, development contractor and consultant.

Lawrence Nault is a member of the Coordinate Systems Analysis Team in the GEOINT Sciences Office of NGA's Source Operations and Management Directorate.

Ted Cody is the Program Manager for Global Net-Centric Surveillance and Targeting, a project of the Information Integration Office in NGA's InnoVision Directorate.

Karen I. Palmer is NGA's Program Manager for Industry Interaction. Retired from the Navy, she is a member of the Defense Acquisition Corps.

Thomas Schellingerhout

Susan Meisner

Dr. Keith Littlefield

Joanna Davis

Jennifer Lafley

Gary W. Fuller

Lawrence Nault

Ted Cody

Karen I. Palmer

Gail Kucera and Henry Kucera are principals in Swiftsure Spatial Systems.

Jim Ressler is a Senior Systems Engineer for Enterprise Architecture at Northrop Grumman IT, TASC.

Steve Panzer is the Vice President of the ObjectFX Government Division. For over 20 years, he has supported programs for image processing, electronic light tables and geospatial visualization at the former National Photographic Interpretation Center and at the National Imagery and Mapping Agency, now NGA.

Brian Beveridge, a Project Scientist in the InnoVision Directorate's Information Integration Office, is NGA's principal investigator for a Cooperative Research and Development Agreement with Minneapolis-based ObjectFX. Assigned to NGA three years ago as an Air Force officer, he has continued working for the Agency as a civilian.

Gail Cherochak is a communications specialist contractor in NGA's New Campus East Program Management Office.

Merrifield Wells Huff was a consultant to the NGA History Branch, Office of Corporate Relations, during the last fiscal year. He retired in 2005 after several years as an NGA Public Affairs Officer in St. Louis and Bethesda.

Sue L. Patterson is Chief of the Integrated Exploitation Capability Development Team in the Acquisition Systems Office.

Gail Kucera

Henry Kucera

Jim Ressler

Steve Panzer

Brian Beveridge

Gail Cherochak

Merrifield Wells Huff

Sue L. Patterson

Technology Begins with You

Letter to our Readers

Technological progress usually starts with an idea. Someone imagines how to do something better, solve a problem or achieve a goal. The Pathfinder dedicates this issue to sharing a few success stories of NGA and our partners, who used technology imaginatively.

At the same time, articles in this Pathfinder also address our challenges. People are looking to us to show the way in scenarios that change constantly. To support them, and our nation, we must continually improve our geospatial intelligence—its timeliness, its availability and its usefulness. So, our intent is to stimulate your thinking about new ways *you* could support our mission.

In our lead feature—"Automated Imagery Analysis: Is Science Fiction Becoming a Reality?"—NGA's Director of InnoVision, Dr. Keith Littlefield, takes us to the leading edge of investigations into automating imagery analysis. As he makes plain, the challenges that imagery analysts face demand that we find ways to free them from analytical work that could be automated.

Without a business model, technology is useless, says Gary W. Fuller in his article, "New Business Model Enables GEOINT Online." In the future, he says, the National System for Geospatial-Intelligence will look more like a "global geospatial information network," a community of partner-users who produce and share geospatial content online.

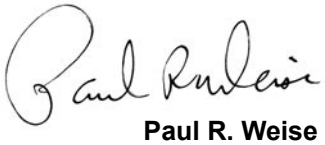
In a dramatic example of GEOINT online, NGA is leading the development of "Guncoast"—a new system that promises near real-time intelligence on targets with the precision required to act on it. The Air Force tested Guncoast in Alaska last summer and gave the system a "thumbs up." Ted Cody has the story.

Meanwhile, NGA had the lead to develop a global reference system for battle-space deconfliction, a project the Secretary of Defense tasked to address today's global threat environment. Lawrence Nault explains how—through exhaustive discussions with our customers—this system evolved into one template for all our warfighters, giving them any place on Earth in seven keystrokes.

Our last feature takes us to the leading edge again, as authors Gail Kucera, Henry Kucera and Jim Ressler explore what may be the next frontier for GEOINT: how to factor in temporal change.

In most of the articles you read, the role of private industry in meeting our technology challenges is evident. Pay attention especially to our "Industry" department for an example of how NGA has collaborated successfully with a small business.

The January-February Pathfinder will highlight the global impact of GEOINT through the combined efforts of NGA and our partners in many nations.



Paul R. Weise
Director, Office of Corporate Relations

On My Mind

Meeting Challenges with Technology

By Vice Admiral Robert B. Murrett, Director, National Geospatial-Intelligence Agency

Our nation's intelligence and defense communities operate during an era of unprecedented global technological change. On Sept. 25, 2006, Director of National Intelligence (DNI) John D. Negroponte reaffirmed this at the Woodrow Wilson International Center for Scholars where he described the "breath-taking" scientific and technological revolution occurring around the world. While many advances such as the increased availability of information over the Internet and the global spread of state-of-the-art commercial technologies have positively expanded humankind's knowledgebase, these developments have also aided our adversaries. According to Ambassador Negroponte, our enemies "are achieving exponential improvements in their operations through widely available, cutting-edge technology in which their research and development costs are any CEO's dream: zero." That is why NGA is committed to working with the Office of the Director of National Intelligence (ODNI) and our intelligence and defense counterparts to exploit path-breaking scientific and technological advances that will enable us to maintain and extend intelligence advantages against national security threats.

How do we remain more agile than our targets at exploiting innovative technologies? From NGA's perspective, we start by expanding our collaboration and by dedicating ourselves to strengthening the processes and procedures needed to identify, develop, acquire and deploy the capabilities and technologies that will enable success.

In an effort to expand partnerships, we will continue working closely with the ODNI on science and technology policy development and planning to better predict, penetrate and pre-empt national security threats. Looking toward the future, the DNI has already publicly proposed opportunities for collaboration such as the Intelligence Advanced Research Projects Activity (IARPA), a parallel organization to the successful Defense Advanced Research Projects Agency (DARPA). This organization would encourage creative, cost-effective research into intelligence challenges and conduct science and technology research that cuts across the Intelligence Community, generating ground-breaking capabilities. The ODNI has also initiated the Rapid Technology Transition Initiative to reinvigorate science and technology across the Intelligence Community and assist elements of the Community with getting their "best-of-breed" technologies into the hands of users. Linking with the ODNI on initiatives such as these will advance our GEOINT mission and give NGA new insight into the technologies that will carry the entire Community into the future.

Continued partnership with government scientists and intelligence, defense and civil agencies on science and technology issues will also help to fill in the "white spaces" between agencies, ensuring that opportunities for technological collaboration are not missed. Furthermore, our continued work with industry and academia to advance research and development efforts within the GEOINT discipline will help us discover and acquire the cutting-edge technologies that will keep us one step ahead of violent extremists.

Beyond partnerships, NGA remains dedicated to implementing and strengthening Agency programs that enable the identification, acquisition, delivery and absorption of the innovative technologies that will solve current, emerging and

prospective GEOINT problems. We have already approved our own policy for Rapid Technology Insertion to make certain that NGA has the timeliest methods in place for replenishing and enhancing its technological queue. This instruction is enabling programs such as our eGEOINT effort, which will help NGA streamline its processes, enhance its support mission partners, and accelerate the Agency's move to a Service Oriented Architecture (SOA). Achieving a SOA will strengthen collaboration with our partners while fully supporting ODNI and Defense guidance.

We also fully utilize our Joint Operations Integration Office to gather, prioritize and champion our Analysis and Production Directorate and Source Operations and Management Directorates' operational, technical and performance requirements to support the introduction of new sources and functional capabilities into the larger National System for Geospatial-Intelligence.

NGA will continue to ensure that the scientific and technological advancements of our time help us to solve modern intelligence and defense problems. By working closely with the Defense Department and ODNI, expanding partnerships and strengthening Agency programs and initiatives, NGA is prepared to meet the challenge.

Robert B. Murrett
Vice Admiral, USN
Director

Up Front

Class Earns First GEOINT-Focused Master's Degree

By Thomas Schellingerhout

The first-ever class to earn NGA's Master of Science of Strategic Intelligence (MSSI) graduated in ceremonies at the Joint Military Intelligence College Aug. 11. With this graduation milestone, NGA accomplished one of its goals in establishing and implementing within the Agency a master's-level degree program focused on geospatial intelligence (GEOINT).

The NGA MSSI program, accredited through the Joint Military Intelligence College, is the only GEOINT-focused master's program in the nation.

Completion of the MSSI field of studies provides numerous benefits for the graduating students. The 17 graduates will return to their respective organizations, bringing with them a heightened level of knowledge in the area of strategic intelligence as well as other intelligence-related topics. But aside from that, these students will also bring intangible benefits from this program as the MSSI education also prepares students for more challenging leadership roles within NGA and within the Intelligence Community (IC). And one other benefit: in addition to providing a master's degree, the MSSI also fulfills the Intelligence Community Officer Training (ICOT) requirement of the Intelligence Community Officer (ICO) designation—a significant milestone in NGA's professional integration within the IC.

HD Director Laura Snow, National Geospatial Intelligence College Director Sandra Wilson, and MSSI Program Director Charles Norville are posing with students of the Master of Science of Strategic Intelligence (MSSI) Program Cohort 1— the first graduating class from the MSSI Program.

Photo by Tony Boone

What makes this program even more attractive to the workforce of NGA is that the MSSI two-year program is both tuition-free and done during duty hours. NGA students are given 16 hours of duty time per week to complete course requirements—a significant contribution by the NGA leadership to facilitate their education. Classes meet twice a week, at the Washington Navy Yard and in St. Louis, and incorporate the newest advances in information technology and video teleconferencing. Upon completion of classes, students are awarded the Post Graduate Intelligence Program (PGIP) certificate. For those students who complete their thesis requirement within the next term following their last class (students have five years to complete their thesis), the MSSI is awarded concurrently with their PGIP certificate.

The program is open to all NGA full-time employees who have two years of continuous federal service by the first day of the academic year being considered, who have completed their baccalaureate, and who have been approved by their supervisor. Applications are submitted through NGA Key Components to the Human Capital Management Board and Joint Military Intelligence College in the fall.

Up Front

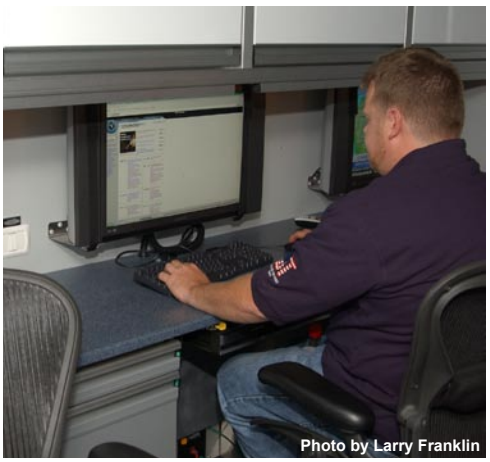
NGA Rolls Out Domestic MIGS

By Susan Meisner

In support of the Federal Emergency Management Agency preparations for Tropical Storm Ernesto, NGA deployed its newest geospatial intelligence (GEOINT) mobile system Aug. 28.

The Domestic Mobile Integrated Geospatial-Intelligence System, or DMIGS, is a self-contained vehicle custom-built on a fire-truck chassis that allows NGA analysts to drive to a crisis location and provide on-the-spot GEOINT analysis and products.

NGA experience in planning for and responding to Hurricanes Katrina and Rita in 2005 prompted development of the DMIGS. NGA already had a military version of the DMIGS that operates out of a high-mobility multipurpose wheeled vehicle, or HMMWV. The DMIGS is a civilianized version of this system and was developed in partnership with Pierce Manufacturing and General Dynamics Advanced Information Systems.



An analyst shows the capability to produce GEOINT products in the DMIGS.

NGA tailored this mobile system to support homeland-security missions including responding to natural disasters such as hurricanes, earthquakes or other catastrophic events. Analysts deploy with the DMIGS to produce tailored, mission-specific products on site. The DMIGS also enables communication and data transfer between itself and various NGA locations.

Custom-built on a fire-truck chassis, NGA's Domestic Mobile Integrated Geospatial-Intelligence System or DMIGS provides analysis and products, as well as communications, on location during a crisis or special-security event.

Automated Imagery Analysis: Is Science Fiction Becoming a Reality at NGA?

By Dr. Keith Littlefield, Director of InnoVision

When imagery analysts perform their work assignments, aside from the visual skill they use, what internal senses become involved in the analysis? What visual signals are processed, interpreted and exploited by the human brain? And, is it possible for a computer to take over some of the interpretation of analysis, freeing up analysts to do more complex work?

Today's experienced analysts handle the increasing volume by knowing what to look for within a subset of the collected imagery. But for future analysts who will face information overload, it is imperative to find ways to reduce the time required for them to screen imagery, as well as assist them in queuing images for examination. If not, how can we accomplish our mission at NGA?

Attempts to automate vision with computers have been ongoing for nearly half a century. However, despite significant increases in computational power and imaging capabilities, fundamental advances in computer vision have been limited. To understand why NGA, through research in the InnoVision Directorate, has been looking at the *nature* of vision itself.

InnoVision is home to NGA's research and development efforts and examines technologies to meet future needs. Finding new ways to help analysts of the future process information more rapidly is one of our goals. Within InnoVision, in our Basic Research Office, we are working with partners to investigate a more effective way of communicating to the computer what analysts see. Through neuroscience—the study of behavior and mental processes of the brain—solutions to help analysts of the future process imagery more efficiently are being sought.

Neuroscience Research Areas

There are three areas for which there are substantial opportunities for neuroscience-based approaches to make an impact:

- Image Triage: how to prioritize the bulk of imagery before analysts deal with it.
- Process Automation: how to "push upstream" or automate, repetitive and time-consuming tasks such as object identification and change detection, so that the abilities of analysts can be better utilized.
- Multi-source Inference: how to register and correlate image-based intelligence with a variety of intelligence sources, for a myriad of purposes.

If automated analysis methods improve, they will be able to assume most of the daily chores of imagery analysts. This will make it possible to leave no image unanalyzed, in the ever-increasing flow of raw data. It will also allow analysts to concentrate their attention on analysis and use their expertise to try new methods to solve problems.

But at the heart of the "vision" problem is the complication that for any two-dimensional image there can be multiple possible interpretations of what is actually on the scene, and there is no way to determine the "right interpretation" with certainty. Differences arise from determination of actual shading, color and three-dimensional depth from two-dimensional projections.

Experienced imagery analysts, using their own visual system, continually resolve these ambiguities with very high accuracy. But how can a computer program duplicate what goes on in the brains of analysts?

A long-term goal of NGA has been to establish a community research program to understand and exploit biological vision systems to address the vision problem. Heading that program for the Agency is Dr. Jeffrey Kretsch, Chief of InnoVision's Geospatial Intelligence Analytics Division.

"We are concentrating on two approaches," said Kretsch. "One is with the Defense Advanced Research Projects Agency (DARPA) and the other is with partners in the Intelligence Community and other parts of the government."

Project with DARPA

Working under DARPA and NGA, scientists are combining a technique, called Rapid Serial Visual Presentation (RSVP), in which small "chips" of images are presented to analysts in rapid succession, with a scanning technique called electroencephalography (EEG for short). Used to monitor analysts' brain activity, EEG looks for a signal that indicates a target within an image has been seen.

Together, RSVP and EEG can be used to queue analysts to a deeper analysis of the images that evoked the detected target signals. This approach addresses the vision problem indirectly; it combines the advantages of the human visual system with neuroscience and signal-processing advances.

Our current basic research is to better understand the nature of these target-recognition signals and how they might address NGA needs. An example would be seeing a car for the first time and trying to understand it by watching how someone drives it.

A More Complex Approach

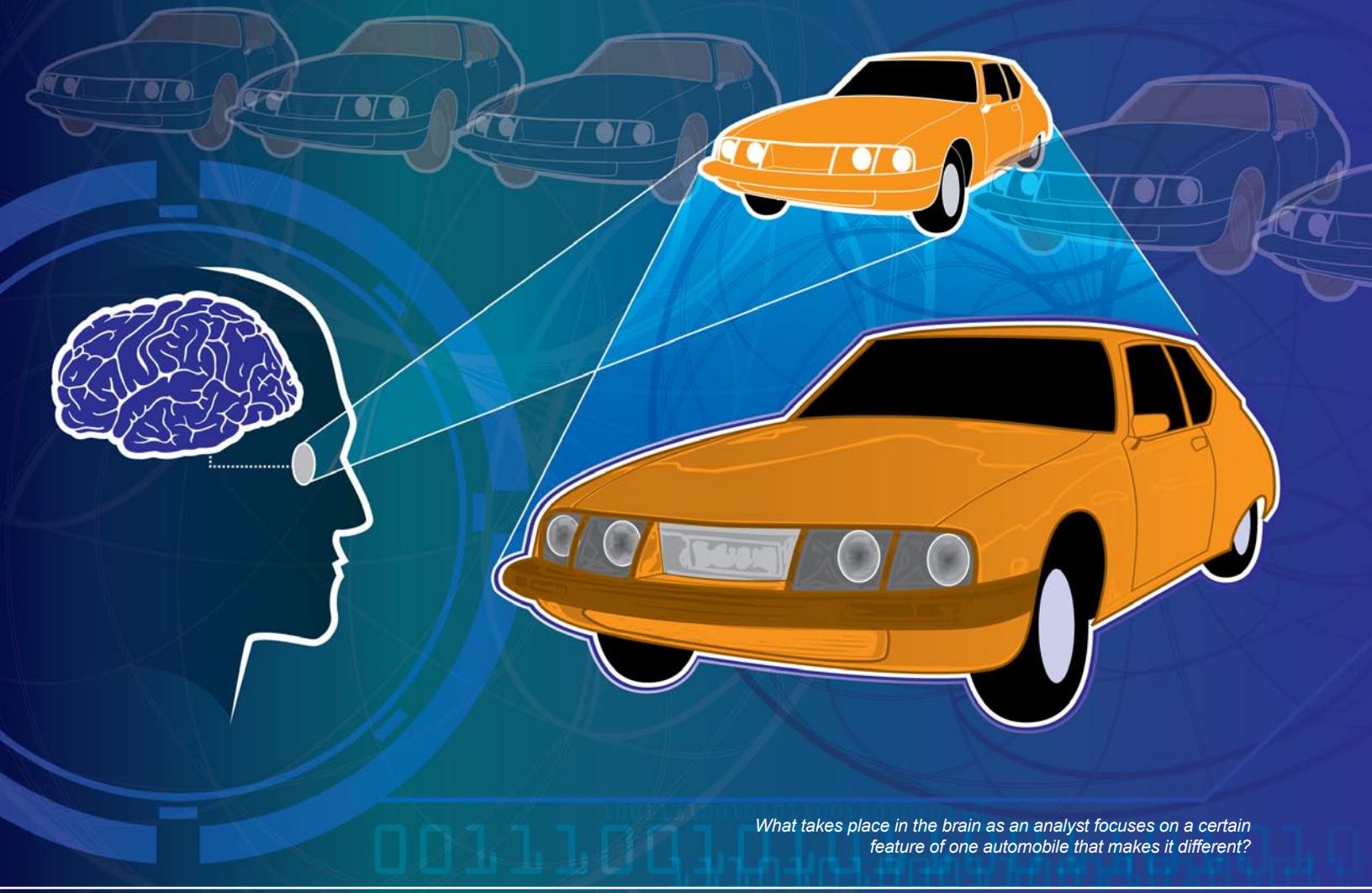
Another approach focuses on investigating biological vision systems at multiple levels, and tries to understand the organizational, representational and computational mechanisms used to enable visual processing in the brain. In this approach, the person would be not only be seeing the car, but taking the car apart to better understand how it operates. This goes beyond traditional neural networks in that the computational models and mechanisms being studied are much more complex.

The goal here is to eventually understand enough to reverse engineer some of these neural subsystems and apply this knowledge to the development of improved computer vision systems. Given that biological visual systems perform accurately and robustly under almost any conditions—a remarkable capability that no computer vision system has come remotely close to matching—and given the recent and ongoing improvements in the understanding of neural mechanism, this approach represents a very promising avenue of investigation.

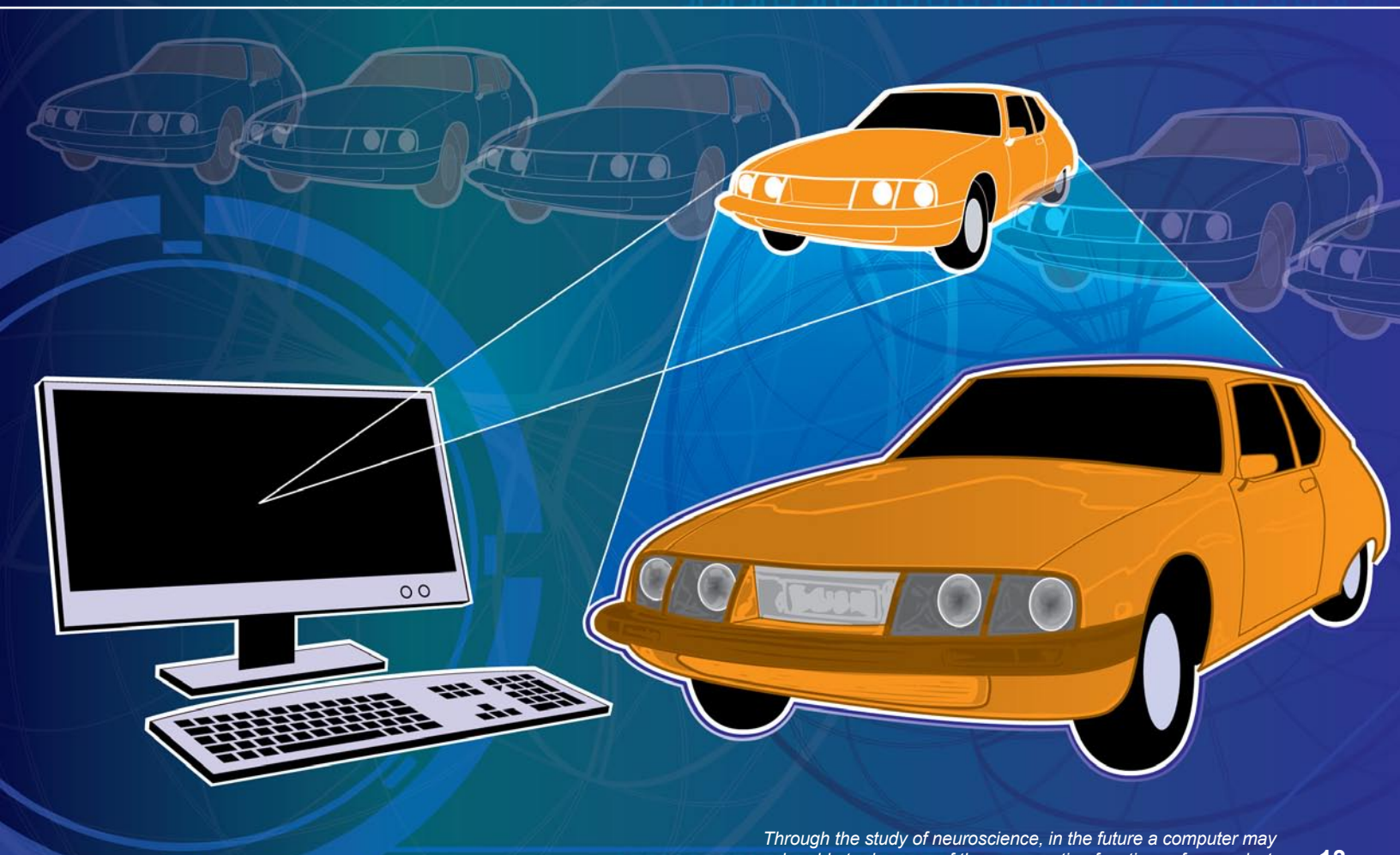
A Critical Need for NGA

This work with our partners by InnoVision's Basic Research Division is a critical need for NGA. The future promises to be challenging for analysts as we develop new sensors to collect more images, while facing adversaries who are mastering new techniques themselves.

The study of the brain and how it processes information is vital to our success in the future. While current computer-based programs can't process vast volumes of imagery with the speed or precision of the human eye, it is hoped that research in this area will assist analysts and lead to new ways to speed up getting accurate information to our customers.



What takes place in the brain as an analyst focuses on a certain feature of one automobile that makes it different?



Through the study of neuroscience, in the future a computer may be able to do some of the more routine functions of an analyst.

NGA Establishes New Policy in Order to Pick Analysts' Brains

By Jennifer Lafley and Joanna Davis

Examining the dynamics of human vision is paramount in NGA's efforts to advance technology's role in geospatial intelligence from image production to include image interpretation. Automating this human sense will allow computers to perform basic steps of imagery analysis to lessen the workload for analysts, and thus expedite intelligence production. However, accurately capturing these processes cannot be done with a standard eye exam. Instead, research must be performed on the human brain, not with tissue samples and microscopes, but by advanced methods of tracking brain activity during visual stimuli.

As NGA prepares to begin human research, it has developed testing methods that will comply with the Department of Defense (DoD) policy on conducting human subject research for the Defense Advanced Research Projects Agency (DARPA) and NGA. The policy, referred to as the Common Rule, ensures that researchers must go through a major checkpoint before testing initiation. The policy came about as a result of the World Wars, and the subsequent science done in the 20th century. At that time there was the realization that humans participating in experiments have fundamental rights to dignity, fairness and justice, and most of all, the right of informed consent free of coercion. Volunteers must know if there are any risks, as well as any benefits, by participating in human research.

The Office of the Secretary of Defense (OSD) is the DoD authority for compliance with the Common Rule. In order to carry out research on human subjects, NGA has developed a policy, a management plan and standard operating procedures. Based on the NGA policy, OSD delegated NGA the authority to accept the assurances of outside researchers that they will comply with the Common Rule in work sponsored by NGA. The Director of NGA has appointed the InnoVision Director, Dr. Keith Littlefield, to be the official in charge of this program.

An Independent Review Board approves testing methods. Not only are the experimental methods reviewed, but the means through which NGA recruits volunteers are subject to scrutiny. Laura Jennings of the NGA Office of General Counsel worked closely with InnoVision and DARPA to develop an approach to recruitment that safeguards the voluntary nature of an employee's participation. "As an intelligence agency, NGA must impose the highest ethical standards on itself when involved with human subject testing, and the process to attract employee volunteers must be free from any type of coercion," said Jennings.

The progress and actions of all research will be reviewed for policy compliance throughout its lifecycle. NGA recently recruited volunteers, who have begun to participate in the study.

NGA must impose the highest ethical standards when involved with human subject testing.

Photo courtesy of Mitre Corporation

New Business Model Enables GEOINT Online

By Gary W. Fuller

Becoming an online provider of geospatial intelligence (GEOINT) and related services is more than a technology shift for NGA. It requires a new business perspective. An enterprise architecture without a good definition of the business it serves is just as bad as having a sailboat without any sails—it can't go anywhere!

Our GEOINT business is one that provides Earth-based products and services to a diverse array of partners concerned with policy, intelligence, defense and homeland security, spanning the gamut from the President of the United States dealing with national policy to a first responder in a local government responding to a flood scene, and from an economic analyst concerned about a five-year economic forecast to a pilot concerned about releasing a precision-guided weapon.

Some users want rapid and direct access to time-sensitive data, while others want custom products and expert consulting services. Some are not people at all, but other computer systems that need continuous feeds of data for navigation or targeting. Increasingly, users want their information on demand and in a format that they can consume to better satisfy their respective missions. NGA's GEOINT business model, organization and systems must accommodate all of them.

To satisfy the mission needs of its partners, the vision for NGA is to be the premier online, on-demand geospatial data, information and knowledge service. This service will provide global access to seamless content, related products and access to experts—whether from NGA or from its business counterparts around the world.

Moving to a GEOINT Network

Our counterpart producers of geospatial content—most of whom also use our products and services—have been referred to as part of the National System for Geospatial-Intelligence (NSG). With the growth of the World Wide Web and Internet technologies and standards it may be more appropriate to think in slightly different terms in the future. The community of partner-users and production counterparts should constitute a global network that produces and shares geospatial content—a global geospatial information network.

What we want to be able to do is create a distributed, global database of seamless content that is accessible to all users who need it. Information access will be primarily through commercial applications that, through standards adopted by the Open Geospatial Consortium (OGC), can import and use data produced and managed in geographic information system (GIS) formats.

The benefit of a network-centric construct is that producers and providers of content—especially those with special local expertise, for example, of a given country or region—will contribute to a virtual, distributed, Geospatial-Intelligence Knowledge Base (GKB). Such a network-centric partnership will enable the NSG to evolve into a network that reaches, acquires, generates, integrates, maintains and shares geospatial content—across member organizations.

Just as in commercial industry, these business partners will have rules of engagement and common standards (especially those promulgated by OGC) that facilitate the sharing of content as well as their business

relationships. Content production and maintenance will be distributed across all of the community members via the network. The global geospatial information network will also facilitate horizontal integration by providing context for multiple intelligence disciplines.

Implementing the Network

As NGA Director Vice Adm. Robert B. Murrett has stated, "NGA should continue to stay agile in order to best integrate NGA with developing defense and intelligence community components."

The most important consideration in implementing the global geospatial information network is that the needs of our partners are well understood and drive the characteristics of future product and service offerings. In addition to having direct access to experts, end-users want and need a self-service capability and the capability to customize their content. These capabilities are hallmarks of an e-business model that supports NGA's need to increase users' capacity for independent action. As a combat support agency, NGA's aim should be to improve our customers' capacity for independent action—not their dependence on us.

To fulfill the vision of a network-centric business model, the current NGA Portal will become the primary access point to all of NGA's content, services and human knowledge and expertise. Human support could be technical support or expert analysis and consulting. Through the Portal, users will also have access to applications, including visualization tools, when they need them, eliminating icon clutter on the desktop. The NGA Portal will be the initial starting point for interfacing to NGA's GEOINT business and the means by which NGA controls the user's experience online.

As an integral part of its online service offerings, NGA will deliver a geospatial framework that shares data in standard ways. The service will provide content layers, including elevations and depths, natural and man-made features, and controlled imagery over which other data, information and knowledge can readily be presented.

Operating Online

Once a global geospatial information network is operational, customized content will become available from member organizations just about as fast as hit songs are downloaded from commercial Web sites. This is the true beauty of a network-centric approach.

As users search the database or roam a "spinning globe," they should be able to narrow the display of geo-registered icons that represent "breaking intelligence," "recent intelligence" or "all we know." Likewise, when a user wants to collaborate with a regional specialist or contact an expert, that information should be accessible through a similar metaphor, like "connect me with an expert in this [geographic] area."

Each offering will need a product or service manager to spearhead its evolution and improvement. Ties between these managers and the staff and contractors who support the development process will facilitate this approach, applying the business model across the enterprise. Innovations to existing products and services as well as concepts for new ones should be implemented rapidly as a result.

Content and Services

Fundamentally, there are three kinds of content that will be available online through a global geospatial information network:

- Standard products like Digital Terrain Elevation Data (DTED®) and Vector Map (VMap)

- Digital products in a non-standard (tailored) format
- Seamless data and information

Services will extend across the spectrum of the business and will include order entry and status for digital and hardcopy products, source management, geospatial exploitation and analysis, content production, online publishing and sharing. It is expected that many new services will emerge from the construct of an online, on-demand information service, such as target monitoring or alerts and notifications when changes are detected.

NGA's Palanterra™ system for homeland security provides the kind of access, presentation and functionality for the United States that ultimately will be extended to the world. First, users will be able to interact with the data directly as displayed on their screens, zooming, roaming and selecting/deselecting items of GEOINT, including features, boundaries, imagery, vector data and intelligence reports. Existing product data will be shown as overlays of index maps that represent the coverage footprint of each formatted product. Some users will be able to satisfy their needs by this direct viewing method—just as most of us search and browse an Internet Web site.

A second way of interacting with NGA's online service will be to cause the displayed content to be printed on large-format, high-resolution, color printers—printers that can rapidly print in the size and quality of a traditional map in the quantity needed for a mission. Users will be able to customize the content of the map or select a traditional map, for example, an Operational Navigation Chart. The same capabilities will support the tailoring and creation by the user of non-standard hardcopy, such as small-format combat graphics overlaid with control measures.

A third way of using the online service will be to download the discrete tiles (at full resolution) that comprise all the layers of displayed content. Once a package is downloaded, users will be able to update data in their area of interest/responsibility and upload it to NGA's Geospatial Knowledge Base. These user-producers will be certified members of the network authorized to perform updates. In any case the descriptive data associated with the update of any tile would be available for other users to review so as to ascertain its quality and authoritativeness.

A fourth and final way to interact online will be to add one or more new imagery, vector or matrix layers to the Geospatial Knowledge Base on a distributed basis: from a local server other users can access. When this occurs, the producer will update the content registry with a characterization of the layer, including the type of data, its geographic extent and currency, and the Internet address of the map or feature server from which it is accessible.

eGEOINT Management Office

Since its standup 10 years ago and especially since Sept. 11, 2001, NGA has come a long way toward integrating its operations and support to its partners' missions. Enabling GEOINT is the objective of NGA's eGEOINT Management Office. To move toward an online, on-demand, information-service business model, the eGEOINT Management Office is sponsoring, accelerating and integrating various projects across NGA, as it works through the Agency's Key Components. Each project will play a role in enabling improved access to GEOINT content and services. Working together, we can achieve the vision of a network-centric business model that better serves our customers.

NGA Earth Is Now Online

First established in 2005 in direct response to Hurricane Katrina, NGA Earth provides access to geospatial data over the World Wide Web at http://www.NGA-Earth.org. This service brings timely geospatial intelligence (GEOINT) to all users with an Internet connection.Via this access point, NGA has been able to bring current imagery to first responders, aiding in rescue and recovery efforts, while also providing unclassified views of the world in support of its traditional military and intelligence customers.

In the near future, NGA Earth will deliver expanded area coverage, additional third-party data, and near real-time unclassified imagery for operational planning. This geospatial context allows the maximum availability of information to those who need it most: tactical military, first responders, state and local government, industry and the general public.

NGA Earth Public Access

The public access tab available at NGA Earth is the focal point for NGA geospatial information releasable to the general public for crisis response. Through a partnership with various industry leaders the public may view imagery through a Web-based interface. For example, you can look at the hurricane relief areas of the Gulf Coast states along with maps of the region. The search capability allows users to locate an exact street address or a place, such as the Louisiana Superdome.

Military and Government Users

A separate tab on the site allows authorized government users to find maps and imagery of hot spots around the world using the unclassified interface of NGA Earth. The interface provides flexible access to reference layers including Microsoft® Virtual Earth™ and Google Maps™.Search capabilities afford the user rapid access to geospatial data. This access is available on the Web for users from .mil and registered federal .gov addresses only.

For Your Enterprise

NGA strives to bring the very best GEOINT capabilities to its customers. NGA Earth was built from the ground up to support incorporation of these mapping interfaces into enterprise portals or Web sites. The possibilities are endless.

Support to tactical operations:

- unclassified imagery and map data
- streaming imagery

Support to crisis operations:

- natural disaster aid and damage assessment
- special-event security and support

Collaboration:

- documentation and file sharing

NGA Introduces Global Area Reference System

By Lawrence Nault

NGA has developed a global reference system for battle-space deconfliction in response to a tasking by the Secretary of Defense. The Global Area Reference System (GARS) is the first to provide a worldwide standard for Department of Defense mission planning and operations. The Coordinate Systems Analysis Team (CSAT) within NGA's Source Operations and Management Directorate developed GARS, and NGA's Office of Military Support managed the interservice coordination of the system.

Even city tourist maps use some form of area referencing with numbers across the top and bottom and letters along the sides. In the armed forces, grid reference systems have historically been developed and used for battle-space deconfliction. Proven reference grids are in use in Afghanistan, Iraq and South Korea.

The predecessor to GARS was the Common Geographic Reference System (CGRS). Around the world numerous CGRSes were being used in the field, all with their own scheme and not compatible with each other. The most noteworthy one was developed for Operation Iraqi Freedom by commanders and support personnel in Iraq. It was hailed as a key enabler of the digital battle space and common operational picture. While serving as a standard for area reference systems, the CGRS set the stage for the development of the worldwide system now called GARS.

Why a Global System?

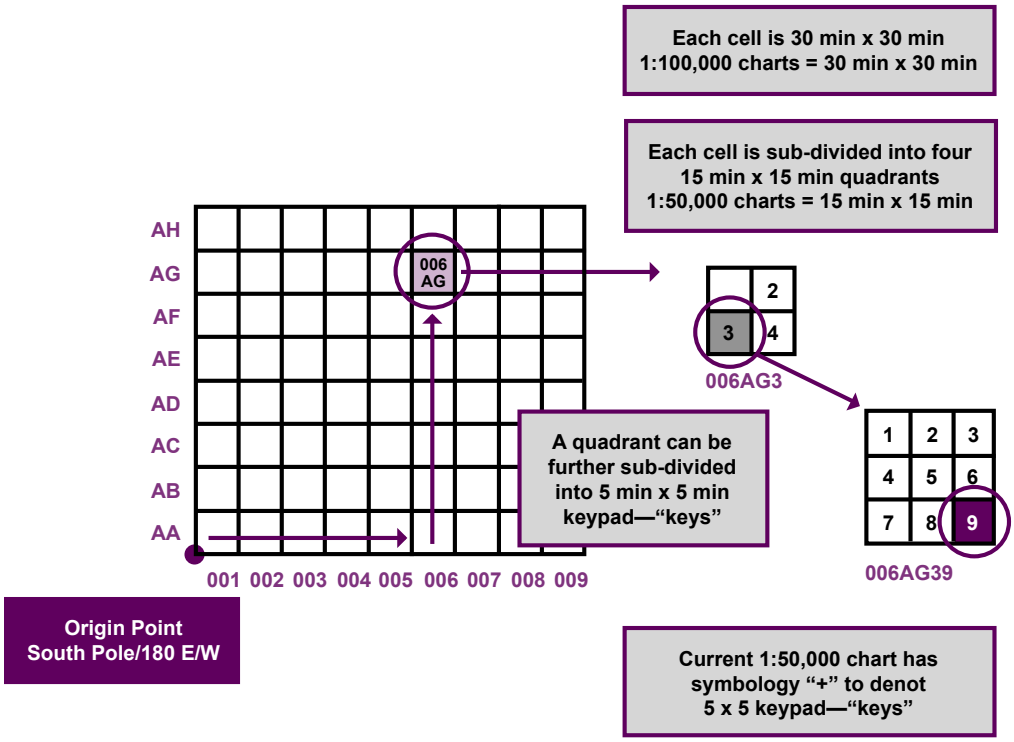
GARS is an administrative measure used to rapidly and clearly define geographical locations for battle-space coordination, deconfliction and synchronization as well as for large-area search-and-rescue efforts. Unlike the geographical grid systems used for the different operational areas, GARS is global in scope, providing a common language between the services / combatant commands and simplifying communications.

Before the adoption of GARS, the combatant commands all had separate area reference systems. But with the global war on terrorism, areas of conflict that overlap seemed more likely to occur. Even with the latest change to the Unified Command Plan, which moved Syria and Lebanon from the U.S. European Command geographical area of responsibility (AOR) to the U.S. Central Command AOR, the borders dividing these two commands and the U.S. Pacific Command continued to pose a challenge. A conflict could have erupted crossing combatant commanders' geographical areas of responsibility (AOR), with the potential for confusion by having multiple common geographic reference systems.

GARS is highly useful in facilitating rapid attacks on time-sensitive targets and for expediting deconfliction of friendly force locations. It is important to note that GARS is primarily designed for battle-space management and not to be used for navigation or targeting.

A global reference system is also needed on the home front. Just as GARS is used to manage the battle-space environment and deconfliction, it can also be used to coordinate and manage search and rescue efforts involving the Federal Emergency Management Agency, U.S. Coast Guard and local governments. And since GARS

Global Area Reference System (GARS)



The diagram shows the construct of the Global Area Reference System (GARS) grid. It also helps to explain the relationship of the GARS grid to various NGA products of different scales.

was developed on a worldwide scale, disaster relief efforts can be managed anywhere in the world without having to rely on different local systems of varying compatibility.

How GARS Works

GARS divides the world into 30-minute by 30-minute cells, about 900 square nautical miles at the equator, diminishing in size at higher and lower latitudes. Each cell is subdivided into four 15-minute by 15-minute quadrants. Furthermore, each quadrant is subdivided into nine 5-minute by 5-minute areas, about 25 square nautical miles at the equator.

The system has many uses to the warfighter. Because it describes any 5-minute by 5-minute area with only seven characters, rather than transmitting a series of lengthy latitudes and longitudes, users can define an area by a brief yet succinct number/letter character string. This enables the location to be transmitted through already-cluttered secure data transmission channels without occupying much bandwidth.

"GARS is expected to be used to rapidly identify locations of friendly surface forces, ground force maneuver boundaries, areas of intended attack to include kill boxes and terrain or airspace orientation," said Air Force Lt. Col. Brett Plentl of U.S. Strategic Command Enterprise Architecture.

Development and Implementation

At a conference hosted by the multi-service Air Land Sea Application Center, over 70 warfighters, doctrinaires, trainers, cartographers, systems managers, software engineers and requirements personnel met to establish the base line for GARS. Attendees represented the services/combatant commands, joint commands and combat support agencies.

From March through August 2005, NGA hosted three joint working groups to solicit base-line requirements for GARS. A global video teleconference was set up with attendees from Germany, South Korea, the United Kingdom and the United States. CSAT developed many area grid schemes and described to the working group the pros and cons of each. In the fall of 2005, the NGA GARS proposal was staffed through the Services / combatant commands via the Joint Staff. It was unanimously supported and subsequently approved in December of that year. In January 2006, the Director of NGA sent a letter to the Secretary of Defense stating that NGA had completed its task of leading the defense community in the development of GARS punctuated by the need for continued community engagement toward full implementation.

Joint Service Publications and Doctrine are being updated as well as Search and Rescue Supplement documentation to include GARS. Several publications that deal with multi-service tactics, techniques and procedures (MTTP) are also affected, including Time-Sensitive Targeting, Joint Fires and Theater Air Ground Systems (TAGS) as well as NGA Technical Manual TM8358.1. The first MTTP that will include GARS will be TAGS. The implementation of GARS may also affect hardcopy NGA Topographic Line Maps. Technical exchanges among the services and NGA are being organized to determine the necessity of GARS on hardcopy and associated margin information.

The Way Ahead

GARS is not a replacement for any existing reference system such as the World Geographic Reference System (WGRS or GEOREF), or the Military Grid Reference System (MGRS) based upon the Universal Transverse Mercator and Universal Polar Stereographic grids. It complements joint fire support and/or airspace control systems and measures. It is not optimized for defining natural terrain features but may be combined with ground-feature references for easier use.

With these important caveats, GARS is the new area reference system for the globe, approved by the Director of NGA. The countless benefits of standardizing a global area reference system are limited only by our imagination. GARS will facilitate significant multi-service coordination at every level in the global war against terrorism and in any future conflicts.

GARS data files are available for immediate use, along with information about how to use GARS, shape files for geographic information systems and FalconView™ software, and a calculator for determining GARS locations from user-defined geographic coordinates. GARS is also being included in the latest edition of GEOTRANS, the DoD standard software for coordinate conversions and datum transformations for mapping purposes. For more information contact the GEOINT Sciences Office at (314) 263-4171 or the Office of Military Support at (703) 264-7292.

Marine Lt. Col. John R. Anderson and Air Force Maj. Brady V. Merrill of the Air Land Sea Application Center at Langley Air Force Base, Va., contributed to this article.

‘Guncoast’ Promises Transformational Targeting Capability

By Ted Cody

NGA is leading the development of Global Net-Centric Surveillance and Targeting (GNCST or “Guncoast”). Significantly shortening the target process, GNCST provides near real-time intelligence on targets that users specify with the precision they need to act on the intelligence. NGA and its partners successfully demonstrated a prototype of the system last June during an exercise in Alaska hosted by U.S. Pacific Command.

With the GNCST system, users will have the ability to rapidly detect, locate, identify and track difficult, high-value targets. GNCST is designed especially for use in denied areas of the world and on targets that might otherwise be unreported by existing intelligence processing systems. The system provides target reports at an accessible classification level, at the level of confidence specified by the user, and in a format friendly to users and their systems.

GNCST is a fully automated process, from the screening of live and archived raw sensor data to the delivery of the final, fused target report in near-real time.

How Guncoast Works

A user’s query initiates the process to automatically scan all available and relevant national and tactical intelligence data. GNCST fuses the results of this multi-intelligence (Multi-INT) data mining to provide the most comprehensive, technically best answer, or answers, to the user’s query.

At initial operating capability, GNCST target reports will be posted to an NGA Web portal on a secure network for direct, immediate access by intelligence analysts and tactical users. In addition to reports on specific time-sensitive or time-critical targets of interest, users will have access to the source data from which the report is derived.

GNCST will use software agent technology, similar to artificial intelligence, to screen a wide range of surveillance and reconnaissance sources, for example, geospatial intelligence, signals intelligence, human intelligence and open source intelligence. GNCST has the potential to ingest and process all sources of data—from both current and planned national and tactical sensor systems and data sources.

GNCST represents a potentially transformational capability that will allow users to maximize the usefulness of intelligence-collection and processing systems to support operations.

NGA Initiative

An NGA research and development initiative, GNCST originated in 2002 under joint Department of Defense (DoD) and Intelligence Community (IC) sponsorship, with NGA volunteering to act as the program's host Agency. It is now an NGA-sponsored program with continued DoD and IC oversight/involvement via a GNCST General Officers' Steering Group acting as a virtual board of directors.

A successful demonstration of the GNCST prototype was held during May and August 2004 as a joint effort among NGA, the National Reconnaissance Office (NRO), National Security Agency (NSA) and Army Threat Systems Management Office, confirming the technical viability of the program's methodology and architecture. Results were very encouraging, with real-world targets being accurately and rapidly detected and reported. As part of U.S. Pacific Command's exercise Northern Edge 2006, another successful demonstration of an enhanced GNCST prototype was held in June. That was a result of Dynamic Time Critical Warfighting Capability, a joint project of the U.S. Strategic Command, NGA, NRO, NSA, Pacific Air Forces and Air Force Headquarters.

Contract Awarded

In late July of 2006, a new, multi-year contract was awarded to BAE Systems and a team of subcontractors to mature the GNCST prototype and complete the development and integration of an operational GNCST capability. The first spiral development capability increment is scheduled to transition to NGA's Acquisition Directorate in September of 2007 for insertion into the NSG baseline. Operational availability for this first spiral is planned for late fiscal 2008. Subsequent spirals will continue to enhance the system's capabilities and add new data sources and targets based on users' priorities.

GNCST represents a potentially transformational capability that will benefit a wide array of users in both the DoD and IC. Its ability to automatically perform Multi-INT data mining and fusion in direct response to user queries and provide timely, relevant and actionable intelligence at a usable classification level represents a significant advance for intelligence support to operations. Once fielded, GNCST will provide NGA with a new and valuable way to support both the Intelligence Community and the warfighter.

System Aims to Enhance Targeting Precision and Speed

By Staff Sgt. C. Todd Lopez, Air Force Print News

At this moment, above Iraq and Afghanistan, American data sensors are collecting information and intelligence about what is happening on the ground.

What happens to the data depends largely on a sensor's owner and its mission. The data could be reviewed immediately, or it could be stored for later use. What is for sure is that terabytes of information, wherever they come from, often go unused—left on a secure hard drive until they are no longer relevant to anyone.

The Air Force is now engaged in an experiment to take that data and make use of it the moment it comes off sensors. During the Northern Edge exercise last June in Alaska, the Air Force tested a system that does just that: the Global Net-Centric Surveillance and Targeting, or GNCST, system.

Data from sources such as unmanned aerial vehicles, the E-8C Joint Stars, the RC-135 Rivet Joint, electro-optical sensors, synthetic aperture radar sensors, signals intelligence sensors and others are all likely candidates to be fed into GNCST.

Called "Gun Coast" by those involved with the project, the system can take near real-time information from a nearly unlimited set of data sensors and process it into usable information for the warfighter, said Maj. Gen. Gregory H. Power, Director of Air Force Operations and Support Integration.

"With GNCST, a lot of platforms and capabilities will be fusing their data into one single funnel, and GNCST is at the bottom of the funnel," he said. "It takes all that information in, and through algorithms, is able to digest and disseminate very quickly and very accurately, the position of something like a (surface-to-air missile) site."

The system uses a Web-based interface on a secure computer network. An end user might access the system and ask it to locate surface-to-air missiles that appeared in a specific region within the last 45 minutes. The GNCST system would then respond, in as little as a few seconds, with target coordinates for those SAMs.

That type of responsiveness and accuracy would be of great use to pilots, Power said.

"If we had a sortie that was going to attack a target, GNCST might identify a mobile SAM system that had moved into the area as the aircraft took off," Power said.

"Of course, the pilot would not know about that," he said. "But by having GNCST and being able to digest that data—getting it accurately and fast—that data would be available for the air operations center to pass to the pilot. This really is a kind of life-saving technology that, once fully developed, is really going to give us an edge on the battlefield."

While the system is only in development now, it "has a lot of promise and we want to see it developed," Power said.

Project Adds Temporal Change to GEOINT

By Gail Kucera, Henry Kucera and Jim Ressler

NGA is the executive agent for the National Technology Alliance (NTA), which is testing ways to manage and use time-varying geospatial information. The ability to exploit multi-source intelligence with time-varying information is a critical requirement, since many types of geospatial information have temporal characteristics.

In the project, called Temporal Evaluation and Assessment (TEA), NTA is working with Rosettex Technology and Ventures Group to accelerate the development of commercial technology that meets the needs of government for time-varying information. With a team of 70 companies, institutes, laboratories and universities, Rosettex manages projects for NTA in three areas: geospatial intelligence (GEOINT), information processing, and analysis and management.

For the TEA project, NGA's stakeholders provided great value by describing their needs, defining scenarios and contacting additional interested parties. TEA can also have a positive effect on the outcomes of important concurrent programs that have spatiotemporal requirements. For example, NGA's GeScout modernization program has many spatiotemporal requirements, and lessons learned from TEA can be applied to address them.

What Is the Challenge?

The best-informed actions are based on an understanding of what has come before (history), what is happening now (current events) and what may happen next (the future). In an emergency, actions and reactions must be decided as quickly as possible while being bombarded with incoming data from all directions.

Computer-assisted decision support must somehow lead to an understanding of the emerging situation using a profusion of data with inherent inconsistencies. The understanding is based not only on what is there, but also on what is happening—in other words, interpreting the changes under way and the forces driving them. The changes themselves are information, including their character, frequency and spatial distribution.

When you can treat change over time as information in and of itself, only then can you answer these types of questions:

- Given a moving feature, where is it likely to go next, and where has it been? What influences its motion? Is there pattern in its motion? Moving features can include vehicles, vessels, troops, refugees, migratory animals, insect infestations and weather systems.
- Given a series of events, is there a temporal pattern in the events? When is the next event likely to occur? Examples of events include crimes, violent weather, disease outbreaks, wildfire hotspots and earthquakes.
- Given a type of geospatial change, is there a pattern in how, when or where the change occurs? Are there other changes that seem to be correlated? Is it possible to use past records of change to predict where and when change will occur in the future? Examples of geospatial changes include erosion, change in vegetation, insect infestation and the spread of disease.

Real-world scenarios that need answers to these types of questions abound:

- To provide security for sporting or political events, incidents are tracked and investigated. Imagine that a suspicious package is reported at a postal station, or an erratic boat is tracked in the vicinity of a VIP boat. Ideally, it is possible to retrieve information about other information in that time frame or locale to see whether imagery, sensors or incidents shed light on the situation.
- Forensic examinations of all kinds need to be able to gather and query information in a locale and time frame of interest. Forensic examination occurs in the analysis of disease outbreaks, seismic events, populations at risk and serial crime. Analysis might start with just a few events that are weeks or months apart. It is critical to be able to search for other similar events and evidence to improve the understanding of the phenomena examined.
- Location-based services need to consider the time and location where a service is available versus the predicted or scheduled routes of moving objects. Or conversely, periods of high-traffic demand could be used to determine when a service is made available. And external forces—flooding, snowfall—could cause managers to divert the nearest resources (for example, buses or snowplows) from planned routes to areas of greatest need.

An ability to find, query and analyze the time-varying components of information enriches the understanding of these and many other situations. Some decision support tools are available for this purpose, but it is difficult to ensure a data flow. The interoperable infrastructure required to work with change over time does not yet exist.

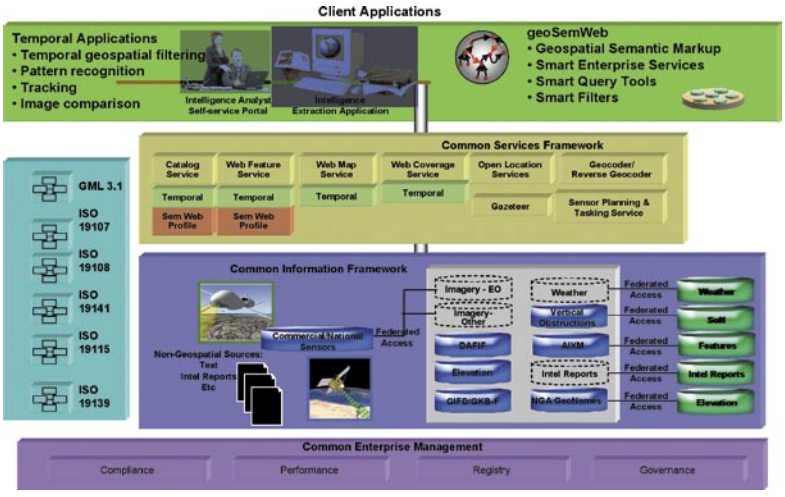
Modern decision-support systems must use standards-based Web-services architecture so they can tap into timely information available from senior webs and semantic nets. However, the interfaces, models and procedures for such architectures are not proven to extend into the temporal domain. Thus, the lack of infrastructure leads to a dearth of data to describe change. Without data to analyze, time-varying information plays only a minor role in decision support.

What Is Lacking?

There is a need to treat change over time as information in and of itself. To do so, the entire Web- services architecture must be extended in a common way. Some examples of needed extensions are as follows:

- In the area of data discovery, catalogs of Web services need to describe the temporal characteristics of data resources. At the simplest level, catalogs must describe the time span represented by a dataset. Ideally, catalogs should describe the time span represented by the particular portion of a dataset of interest. Catalogs also should describe whether a dataset is multi-temporal and how temporal change is represented (for example, as a sequence of snapshots, as detected changes explicitly described, or as a linked list of features). Extensions to

A GeoEnterprise Solutions system architecture is extended to include temporal applications.



content descriptions and catalog query mechanisms both are needed.

- In the area of data retrieval, geospatial models must have standards-based extensions to describe change over time. Existing standards are general and individual implementation can vary enough to impede interoperability. The International Standards Organization (ISO) has drafted a standard for describing changes to features (geometric objects in space) over time. Time-varying coverage, including imagery, is not yet addressed by ISO standards.
- In the area of data analysis, most temporal geospatial-analysis software systems do not use Web-services architecture. It is possibly a chicken-before-the-egg situation, since Web-services architecture does not yet offer a data feed to such systems. However, this isolation from the data-rich world marginalizes temporal analysis of temporal pattern.

How To Move Forward

The TEA environment supports experimentation and collaboration to achieve the following:

- Develop operational work flows for use of temporal data and applications.
- Evaluate and test standards for capabilities and shortcomings with respect to temporal capabilities.
- Define data schemas and databases with temporal capabilities.
- Develop a compliance engine that extends to temporal services.
- Identify technology gaps and potential solutions.
- Validate requirements for temporal capabilities and increase stakeholder participation from the Intelligence Community.
- Deliver a persistent unclassified environment for the evaluation, integration and testing of standards, interfaces, software and data.

TEA provides a bridge by which capabilities of interest can move through phases of specification, development, evaluation and integration prior to beta testing for specific production environments. The establishment of a standards-based facility separate from a particular production environment will ensure that software is broadly usable and not tied to one particular agency's needs. This is critical to ensure commercial success and sustainable commercial support.

The TEA project is engaging two communities of interest:

The first community is the stakeholders who have a vested interest in collaboration. The stakeholder community includes industry partners who develop products that advance the treatment of geospatial change, groups that define standards for geospatial data and services, and those involved in projects with complementary goals. Stakeholders participate through data sharing, software evaluation and involvement in pilot demonstrations.

The second community is prospective users within the U.S. government. The user community will be engaged through workshops and software evaluations to articulate their needs, prioritize capabilities to be developed and evaluate the results.

Temporal Evaluation Assessment

The first step in the TEA project was to create a persistent test environment based on a Web-services architecture developed by Northrop Grumman IT-TASC using its GeoEnterprise Solutions™. The result focused efforts to address the many challenges of achieving seamless and usable systems that handle time-varying geospatial information.

There were three TEA capability demonstrations, each of progressively greater sophistication. Each demonstration defined a realistic scenario based on genuine requirements expressed by the user community. The process of creating a demonstration revealed the capabilities that are ready to introduce to users and also the barriers to remove and gaps to be filled.

The first demonstration focused on the framework and interfaces needed to handle core types of time-varying information: moving features, sequent imagery, sequent vector maps, incident data and sampled features whose attributes change. The second demonstration focused on the temporal aspects of performing feature updates and retaining a historic record of feature versions using a supersede-not-delete approach. The third demonstration built on the core capabilities to integrate applications that lead to a decision-support capability.

TEA will support incremental improvement in capability by simplifying the process of assessing new technology and by reducing the disruption of introducing new technology.

Project Payoffs

Lack of infrastructure is a significant barrier preventing the incorporation of time-varying information into decision-support systems. Providing infrastructure to incorporate such information must be a coordinated effort that involves industry, users and standards bodies. Benefits of this comprehensive approach include the following:

- **Reduction in technology risk.** Technology providers are encouraged to innovate when broad communities of interest signal their stability by defining and validating open interfaces that express their needs. Working with consortia like the Open Geospatial Consortium and World Wide Web Consortium can encourage technology providers to demonstrate their integration with other standards-based products as a part of doing business.
- **Advancement in temporal conventions and use.** Through research and prototype development, TEA will advance the adoption of temporal information in databases, standards, interfaces and client applications.
- **Improvement of choice and competition in the marketplace.** Since no single application meets the needs of all users, an open environment permits different applications to be used for what they do best.
- **Reduction in technology life-cycle costs.** By using standards-based commercial applications in the technology architecture, less custom computer code needs to be maintained.
- **Rapid insertion of new technology.** By working with industry and academia to implement ISO standards and OpenGIS® specifications, new technologies are easier to insert into an existing architecture.

With these benefits, the result will be the emergence of commercial standards-based software that can move unimpeded into the mainstream. Thus, decision-makers can consider a wider array of information, with like improvements in the quality of decisions.

This article originally appeared in the March 2006 issue of GeoWorld magazine (www.geoplace.com). It is reprinted here with permission. Information was added about NGA and the National Technology Alliance.
Gail and Henry Kucera are principals in Swiftsure Spatial Systems, a Rosettex partner. Jim Ressler is a senior systems engineer in Enterprise Architecture at Northrop Grumman IT-TASC.

What Does NGA Need from Industry?

Industry Interaction Is Helping to Build Relationships Between Industry and NGA

By Karen I. Palmer

NGA's mission partners encompass a widening array of decision-makers and operational forces. Their interests include protecting national security, combating the threat of terrorism, implementing national policy, responding to natural disasters and countering illegal drug trafficking. To be successful, they require geospatial intelligence (GEOINT)—foundation data, information and services—tailored to meet highly specific needs, delivered faster, in an easily understood format.

But neither NGA nor the Intelligence Community as a whole can perform this mission on its own. NGA's industry partners offer ground-breaking thought, pioneering research and in-depth technological expertise to the Agency's business operations and production methods. They help NGA build the revolutionary capabilities the Agency needs to remain the premier GEOINT provider.

NGA has promoted teamwork between and among government and industry while keeping in mind that NGA has a fiduciary and contractual oversight responsibility to ensure contractors meet contract specifications. The NGA workforce is now more than 50 percent contractors, who are vital to the Agency's operations and successes.

Industry Interaction

In 2003, NGA created an Industry Interaction (II) process where companies can submit ideas, capability statements, white papers and unsolicited proposals knowing

NGA's Industry Interaction Panel, which reviews company submissions, is composed of the Director of the Small Business Programs Office and senior technical representatives from across the Agency.

Photo by Rob Cox

they will receive an NGA response to each submission. In addition, all industry executive visits are coordinated through this process.

II continues to serve as the central point of contact for industry to interact with NGA. It ties together in one office all industry-interaction activities not otherwise solicited through the normal procurement process. In May 2005, II established a database that permits information to be stored and recalled later as a possible solution for new requirements. Currently 1,148 vendors and over 5,800 documents that pertain to industry submissions and visits are in this database.

Part of II is the Industry Interaction Panel (IIP), which is an executive panel composed of the Director of the Small Business Programs Office and senior technical representatives from across NGA. Within two weeks of a panel meeting, the panel carefully reviews company submissions and mails written correspondence to the company on the status of its submission. Between Oct. 1, 2005 to July 31, 2006, companies sent 119 submissions. Some companies made several submissions. The panel forwarded 80 percent of the submissions for further technical evaluation. Some companies went on to participate in NGA's technology-insertion program, some signed cooperative research and development agreements, and some won subcontracts in partnership with prime contractors. NGA has awarded contracts to nine vendors using this process.

Based on industry experience and feedback, NGA believes this initiative is unique in government and encourages those who are interested in potentially supporting NGA's mission to participate in the II process. For more information on the II process, visit www.nga.mil and click on "Business Opportunities" and the sub-link "Industry Interaction Activities with NGA," or contact Karen I. Palmer, Program Manager for Industry Interaction, or Anthony Morrisey, Project Manager for Industry Interaction, at industry@nga.mil.

Small Business Programs Office

NGA continues to be committed to supporting small and disadvantaged businesses with a robust Small Business Programs Office. The Office is very proactive and involved with a majority of NGA's procurement acquisitions to ensure small business opportunities.

NGA understands small businesses are a critical piece in supporting the mission. On the road, the Small Business Programs Office sponsors and attends various conferences to introduce NGA and help small businesses do business with the Agency.

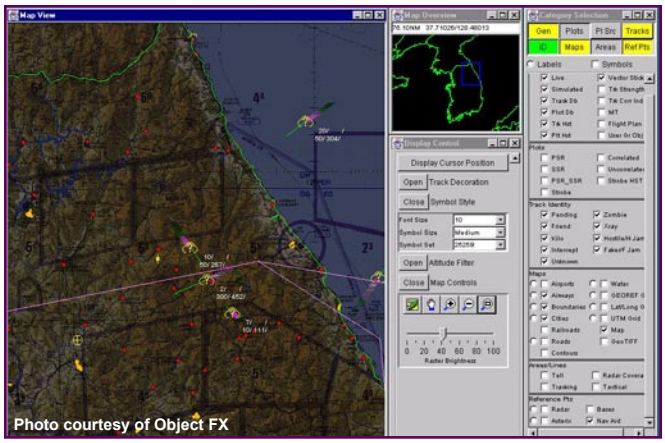
NGA has an active small business vendor list and shares it with many other Department of Defense components. For more information about the Small Business Program Office, visit www.nga.mil and click on "Business Opportunities" and the sub-link "Small Business Interaction with NGA."

Industry

Company Achieves Success Through NGA Program

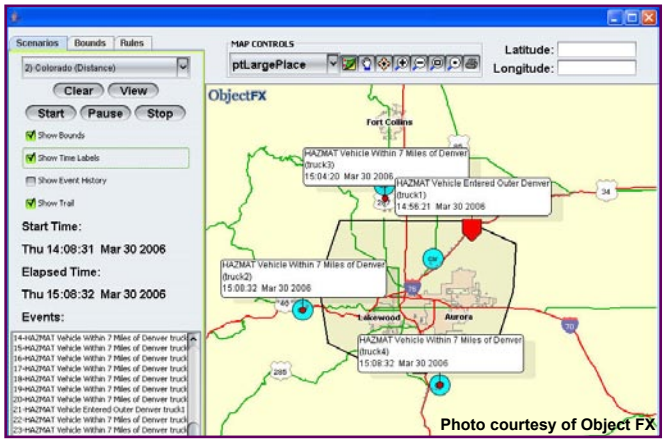
By Steve Panzer and Brian Beveridge

When ObjectFX approached NGA seven years ago to explore a Cooperative Research and Development Agreement (CRADA), it was already in the commercial market for geographic information systems. The Minneapolis-based company provides a Java-based software platform called SpatialFX that enables the integration into enterprise applications of location-based services like vehicle routing and address geocoding.



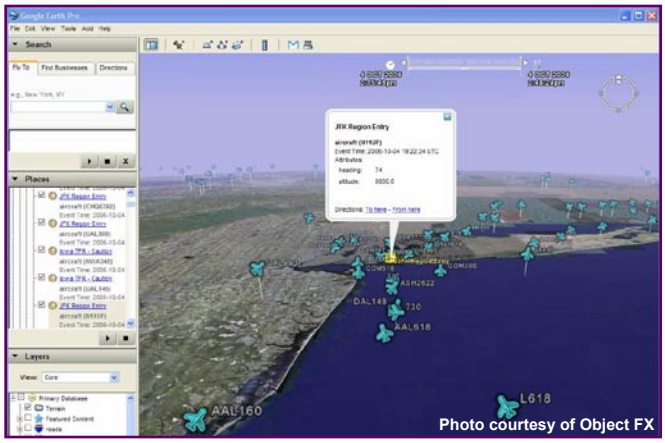
SpatialFX® visualization of dynamic aircraft data over CADRG and vector maps. Support for NGA data formats in SpatialFX® was created under the NGA CRADA.

The problem was that this small business lacked experience with the Department of Defense (DoD) and Intelligence Communities (IC), and the specific needs of the military and intelligence users. The solution was to enter into a CRADA where the goal is to create a technology partnership that benefits NGA's customer base while making the commercial partner's technology more attuned to the unique requirements of DoD and the IC.



SpatialRules™ executing proximity and entry rules from HAZMAT vehicle updates, over SpatialFX®. SpatialRules™ was first prototyped by ObjectFX under the NGA NTA contract.

In the resulting CRADA—"Interactive Mapping on the Web through the use of Java Geospatial Components"—ObjectFX added support for NGA geospatial data types and military standard symbology to its suite of tools. This year the CRADA was renewed to incorporate ObjectFX's new spatiotemporal rules capability into advanced Web-based prototypes.



SpatialRules™ showing proximity of aircraft visualized with Google Earth™ Pro. A pilot integration of SpatialRules™ with Google Earth™ is part of the next CRADA phase.

Working with NGA's Geospatial-Intelligence Advancement Testbed (GIAT), ObjectFX is integrating analytics and automated reporting with the latest geographic visualization systems for enhanced usability.

In addition to the CRADA, ObjectFX has participated with NGA's Industry Interaction (II) Panel, which has allowed the company's technology solutions in the area of spatiotemporal rule processing to be introduced to a broad cross-section of NGA's technology leadership. (See the related article, "What Does NGA Need from Industry?" in this issue.)

Participation in these NGA outreach programs has provided ObjectFX with insight into the needs of the NGA community and has allowed the company to better target their research-and- development funds to be responsive to the needs of the DoD and IC. Because of this participation ObjectFX technology was selected for a variety of NGA-fielded programs like the Imagery Exploitation Support System. ObjectFX was also selected as a subcontractor to Rosettex in the National Technology Alliance program sponsored by NGA. These successes would not have been possible without the partnership that was created through the CRADA and II programs.

Cooperative Research and Development Agreements

A Cooperative Research and Development Agreement (CRADA) is a flexible legal document that allows a private-sector company or university and NGA to work together on a project for mutual benefit. NGA may contribute personnel, equipment, services and property but may not provide funds to the private-sector collaborator. The non-federal collaborator may provide funds as well as personnel, services, equipment and property.

CRADAs allow NGA to transfer technology, information, processes and expertise to the private sector, and to exploit commercial technology. They provide NGA hands-on access to use and evaluate leading-edge tools and technologies. CRADAs often incorporate NGA requirements into commercial products and services.

For private sector collaborators, CRADAs provide direct insight into NGA's data, data standards and processing. These agreements offer companies the opportunity to work with technical experts using advanced tools and technologies in a production environment to expand capabilities.

The NGA CRADA Handbook provides detailed information, instructions and a template model agreement and research plan. It is available at http://www.nga.mil/crada.

New Campus East

Information Technology Is Key

By Gail Cherochak

The workforce can look forward to enjoying world-class, state-of-the-art information technology (IT) that will be available when NGA's New Campus East (NCE) opens in 2011. The Base Realignment and Closure deadline is Sept. 15, 2011. Even without the move, NGA would continue to acquire new IT to improve the technical support, access to data and responsiveness needed for executing NGA's mission. However, with the advantage of designing its own facility, NGA and its customers will have an unprecedented opportunity to use new technologies in an IT environment that is tailor-made for geospatial intelligence (GEOINT).

Every day IT plays a critical role in NGA's ability to perform its GEOINT mission. The consolidation of several eastern NGA sites at NCE will collocate assets from several diverse environments into one unifying environment that enhances integrated operations, cultivates horizontal integration and increases mission assurance. As a result, the work of NGA's analysts will be transformed through increased technological compatibility and connectivity within the Agency and with NGA's partners, creating new opportunities for collaboration among experts. This collaboration is critical as NGA handles dramatic increases in the volume, velocity, variety and veracity of data, and issues that will drive the future of GEOINT.

The plan for IT at NCE is to install an integrated IT architecture that is high-tech, flexible, reliable, secure and scalable in order to provide IT services, operations and support for customers in the 2015 GEOINT environment and beyond. This infrastructure will include video, networks, workstations and IT enterprise management. NGA's goal is to install flexibility that will enable smooth integration of the emerging enabling technologies. These include Voice over Internet Protocol, or VoIP, the routing of voice conversations over the Internet, and blade servers—high-density servers that can support 100 or more computers, thanks to a blade enclosure (chassis) that consolidates the power, cooling, networking and management the computers (blades) require.

Because IT, construction and the movement of people and equipment are highly interdependent, the design, delivery and installation of IT are being carefully coordinated with the NCE construction and transition-move schedules. The design phase includes planning for critical components of the NGA technology enterprise, including the storage and distribution of data holdings, enterprise services for 24/7 operations, and a testing environment for new systems. In addition, acquisition strategies, security reviews and engineering requirements for cabling, space, power and cooling of IT areas are being defined. As the IT planning evolves, interdependencies with other functional areas of NGA—especially NGA West—have been noted to address the continuity of operations during the moves of the workforce to NCE, scheduled to begin in 2010.

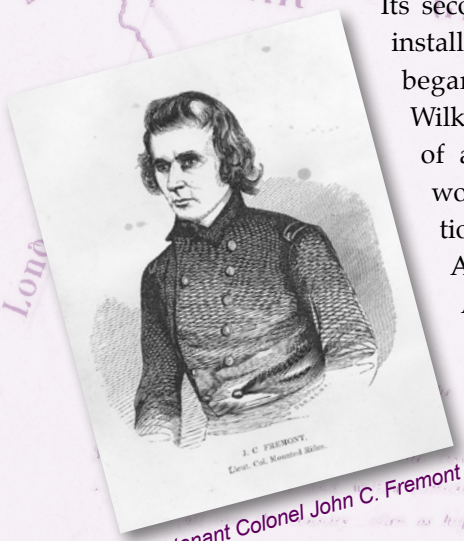
So, will employees be instant messaging and chatting online to conduct GEOINT analysis, attending video teleconferenced meetings from their desktop workstations, or attending training through virtual classrooms? All of these are possibilities. All we need is the IT infrastructure that will make them possible.

The Original Pathfinder, John Fremont

By Merrifield Wells Huff

Meriwether Lewis and William Clark's 1803-1806 expedition was only the beginning of our nation's effort to develop a systematic geography of the pathways and waterways of the American West. Many other expeditions followed, driven not only by the desire for scientific discovery, but also by the need to show the way for America's increasing migrations westward. Those in turn were backed by the politics of expansionism, free trade and military protection, and defense.

America's growing interests reached both across the land and across the seas. In 1818 Maj. Isaac Roberdeau was named head of the new War Department Topographic Bureau to inventory and store surveying instruments, maps and charts. In 1829 Maj. (later Col.) John J. Abert added the Corps of Topographic Engineers to this reorganization. In December 1830 the future Naval Observatory was established as the Depot of Charts and Instruments. Its second director, Charles Wilkes, installed a lithographic press and began the production of charts. Wilkes left in 1838 to take command of a four-year expedition that would gather scientific information and chart routes to ports in Australia and Hawaii and on the American Pacific Coast. Wilkes would there accomplish, for our knowledge of the seas, what Lewis and Clark had earlier accomplished on land. Matthew Fontaine Maury, the bureau's fourth director, transformed it into the present Naval Observatory.



Lieutenant Colonel John C. Fremont

Reflecting this outburst of geographic curiosity, Abert in 1842 instructed a 29-year-old second lieutenant in his Corps of Engineers, John Charles Fremont, to lead expeditions to explore and map the West. These missions, at least one of them equipped at the St. Louis Arsenal, NGA West's future home, surveyed the Oregon Trail (1842), the Oregon and California territories (1843-44) and the Great Basin and access through the Sierra Mountains to California (1845). Out of these explorations Fremont and his assistants produced more than 200 maps.

But even in those days Congress had its own agenda. Fremont's expansionist-minded father-in-law, the influential Missouri Sen. Thomas Hart Benton, had given him an additional duty. His journals would be filled with descriptions that would make the West and western travel appear as attractive as possible to Americans living east of the Mississippi.

With the assistance of his wife, Jessie Benton Fremont, he achieved great success with his first mission. Written in a narrative style, his report was literally a best seller. Published by Congress in 1843, it was picked up by all major newspapers. The 20,000 copies published by Congress were immediately followed by at least six commercial American editions, two English editions and several in foreign languages. One of the American editions may have exceeded 100,000 copies.

Fremont probably never profited from the sales of the report, but as an author he was as much read in his day as Louisa May Alcott or Harriet Beecher Stowe. In the popular mind he began to be known

Photo courtesy National Archives

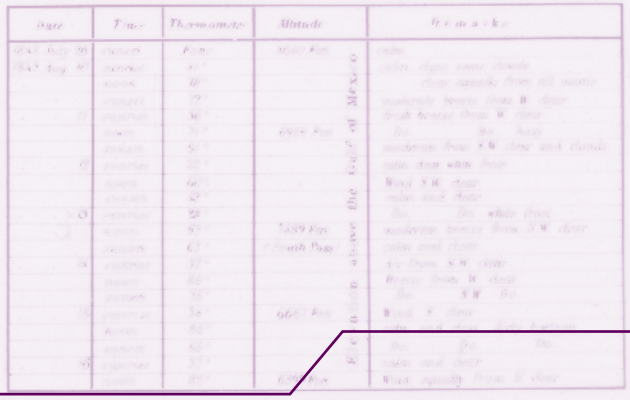
The Fremont Building, located at NGA headquarters in Bethesda, Md.

as "The Pathfinder." And the new maps? They were the cartographic standard for the next 20 years.

In later life Fremont was not as successful as in the early years of his expeditions. He left the military in 1847 after a conflict of command and a resultant court martial. As a civilian living in California he acquired vast land holdings but lost all through unwise investments. He ran for President in 1856 as the first candidate of the new Republican Party and lost badly to James Buchanan. Returning to the Army at the beginning of the Civil War, he was put in command of the Department of the West, headquartered in St. Louis, but proved inept at administration and was removed by President Lincoln. From 1878 to 1881 he was governor of the territory of Arizona, and in the last year of his life he was appointed by act of Congress a major general and placed on the retired list. He died in New York, July 13, 1890.

The well-known author Larry McMurtry, reviewing a recent biography of The Pathfinder, said Fremont may have been the first American celebrity to be undone by celebrity. This columnist thinks not. John Fremont was the second. Meriwether Lewis was the first. Lewis became increasingly moody and unstable in the months after the completion of the successful and wildly popular expedition and died under mysterious circumstances only three years later.

To honor Fremont's accomplishments, an NGA predecessor, the Army Map Service, dedicated the Fremont Building to his memory when it was completed in 1944, exactly a century after his most publicized expedition to Oregon and California.



Partnerships

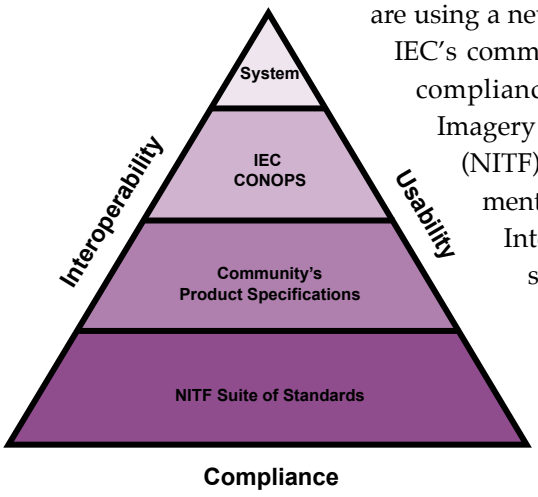
DISA and NGA Collaborate on IEC Testing

By Sue L. Patterson

NGA and the Defense Information Systems Agency (DISA) are breaking new ground as they collaborate to test commercial off-the-shelf (COTS) applications provided by NGA's Integrated Exploitation Capability (IEC).

The IEC is NGA's geospatial intelligence (GEOINT) exploitation system. An integrated collection of commercial and government exploitation tools, the IEC is currently deployed on over 2,500 workstations at over 70 sites worldwide. Supplementing or replacing existing exploitation/production capabilities, the IEC provides access to large imagery repositories and all-source intelligence as well as tools for multi-intelligence data fusion. It is the backbone exploitation-services capability within the Knowledge, Production and Exploitation (KPE) element of the National System for Geospatial-Intelligence (NSG).

NGA's IEC Program and DISA's Joint Interoperability Test Command (JITC) are using a new approach to test the IEC's commercial applications for compliance with the National Imagery Transmission Format (NITF). The NITF is a Department of Defense (DoD) and Intelligence Community suite of standards for the exchange, storage and transmission of digital-imagery products and image-related products.



NITF "Community Focused" Compliance Testing

JITC tests the hardware, software and components of information technology systems used for national security. With its one-of-a kind array of test beds and uniquely qualified staff, JITC provides "one-stop" systems testing for DoD, combatant commands, federal agencies, allies, coalition partners and commercial vendors.

Lessons Learned

The origins of NGA's ground-breaking collaboration with DISA began six years ago when JITC's NITF Lab provided the expertise to baseline the NITF capabilities of the IEC and its electronic light tables. The Lab is the executive agent for NGA's NITF Test and Evaluation Program. Numerous NITF specification and NTM product-compliance issues were identified, and several important lessons were learned:

- Major IEC components should be NITF-compliant and produce consistent and interoperable products.
- Early intervention of NITF test efforts, focused on particular missions or focuses of interest, pay huge dividends (fewer discrepancy reports) at system deployment time.
- Close and cooperative relationships between independent test (JITC), integration (IEC contractor) and development (COTS vendors) personnel yield consistent and orderly identification and resolution of segment and enterprise shortfalls.

Little did anyone know early on that such a synergetic arrangement would flourish and continue to reap benefits years later

and again prove worthwhile in preparing for future NSG sources.

Breaking New Ground

Today, JITC and the IEC Program are collaborating in several key areas to facilitate NGA's transition to the Future Imagery Architecture, NextView commercial imagery, and Advanced Geospatial Intelligence products. Together, they have identified the operational needs for future products, translated them into NITF test objectives, identified a concise cross-section of test files and resources, and formulated procedures to exercise the COTS applications and resulting products.

With the COTS developers observing, JITC and the IEC Program assessed six applications in 2005 for their ability to process various products provided by the Future Imagery Architecture. As a result of this effort, an average of 24 issues, of various degrees of severity, were identified with each application. While many of the issues were minor infractions of NITF and Future Imagery Architecture specifications, several were critical and had the potential for serious mission impacts if they had gone undetected until initial operating capability. The team identified these issues at least six months prior to factory acceptance testing, which allowed time for the vendors to correct shortfalls and ensure product readiness.

Similar assessments, involving both JITC and the IEC Program, are under way to facilitate the deployment of Advanced Geospatial-Intelligence Processing (AGP) and next-generation commercial-imagery sensors.

Model for the Future

Rather than testing solely for generic data-format compliance, the testers for DISA and NGA worked together to understand the new imagery products and processes associated with an application. This approach enabled them to plan and manage NITF-compliance testing that supports specific mission needs and expectations. By working together, all the parties associated with the fielding process—testers, integrators and the developers of systems and COTS applications—have much to gain in future system/segment deployments.

The author acknowledges contributions to this article from George Levy of Data Systems and Technology Inc., who works with the Defense Information Systems Agency's Joint Interoperability Test Command, and Michael Petroski of Lockheed Martin Co., who supports NGA's Integrated Exploitation Capability Program.

IEC Team Wins DoD 'Top 5' Award

On Sept. 25 the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics and the National Defense Industrial Association (NDIA) recognized the IEC Program as DoD's most successful acquisition program, in particular, for excellent application of systems engineering best practices and integration to achieve program success.

Awards are given to both the government procurement activity and the prime contractor. The IEC Program Manager, James Sapcoe of NGA, and the IEC System Manager, Doreen Cohen of the Lockheed Martin Co., were scheduled to receive the award at the ninth annual Systems Engineering Conference in San Diego Oct. 25.

"This is definitely a team award reflecting the combined efforts of our contractor, the Acquisition Directorate and our customers," Sapcoe said.

NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

capture the vision

celebrating 10 years of GEOINT


celebrating 10 years of GEOINT
NGA


NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

WWW.NGA.MIL